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# **The Cost of the District Hospital**

## **A Case Study from Malawi**

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Hospitals in Malawi absorb most of recurrent district health expenditures, and district hospital expenditures for drugs and medical supplies are of the same magnitude as that for personnel. Except for drugs and food, there is little scope for major savings in Malawi's hospital operating costs, unless the inflow of patients can be reduced.

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This paper — a product of the Population, Health, and Nutrition Division, Population and Human Resources Department — is part of a larger effort in PRE to analyze the costs and financing of hospitals in developing countries. Copies are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Otilia Nadora, room S6-065, extension 31091 (36 pages, with tables).

Mills analyzes the cost to the Ministry of Health of providing district health services in Malawi, with an emphasis on the cost of the district hospital. She reaches several conclusions:

- Except for drugs and food, there seems to be little scope for major savings in hospital operations costs, unless influences could be brought to bear to reduce the flow of patients to the hospital. In general the hospitals were well (often over-) used and lengths of stay were already relatively short by international standards. Only one or two members of the hospital staff were obviously underoccupied and could be reallocated to other duties.

- To increase the hospital's role in districtwide activities, efforts should probably be made to increase staff motivation to work outside the hospital, to provide vehicles (such as motorbikes) that are not suitable for patient transport, and to introduce incentives to keep those vehicles in working order.

- Detailed costing of hospital activities is feasible in a low-income country like Malawi. Mills's costing methodology could be used in other studies.

Mills's analysis provides firm evidence to assess district resource allocation patterns, by carefully disaggregating district costs by level of

care and department. Mills focuses on average costs and the distribution of cost by input category, cost center, and direct service department.

A strikingly low proportion of district recurrent costs was absorbed by salaries and wages: between 27 percent and 39 percent, depending on the district.

A surprisingly high proportion was absorbed by drugs and medical stores: between 24 percent and 37 percent.

The hospital's largest cost center — in terms of resources it controlled — was the pharmacy.

Between 27 percent and 39 percent of total recurrent costs were spent outside the hospital, and a corresponding 61 percent to 73 percent were spent on district hospital services. The hospital's secondary care services alone absorbed 40 percent to 58 percent of district recurrent costs.

Average costs by hospital department showed considerable variation by district, with one hospital being consistently the most expensive and another the cheapest. Between three and ten new outpatients could be treated for the average cost of one inpatient day, and between 34 and 55 for the average cost of an inpatient.

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A Case Study from Malawi

by  
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## INTRODUCTION

In recent years, the attention of policy-makers and researchers has been directed at primary health care, with little notice taken of hospitals except to observe that they take a disproportionate share of health sector resources. However, it is precisely because they are large consumers of resources that more attention needs to be paid to them by policy makers and researchers. It is conventional and traditional to describe developing country health systems as hospital-dominated, with the bulk of resources devoted to hospitals in urban centres. Casual investigation and observation certainly suggest this is the case. Yet the higher levels of a health system have an important supportive role in terms of supervision and referrals. Thus relevant questions are: what mix of facilities is desirable, how can they be most economically provided, and how should resources be shared between the different levels of facility.

Very few in-depth studies have been done of the economics of hospitals in developing countries.<sup>(1)</sup> The study reported here reviews the allocation of Ministry of Health resources within six districts in Malawi, with particular emphasis on the proportion of resources absorbed by the hospital and on the production of unit costs for hospital departments. The objectives of the study were to develop policies and guidelines to

- (i) increase the efficiency of hospital operations, and
- (ii) improve the intrasectoral allocation of health sector resources.

## METHODOLOGY

### Selection of districts

Due to physical constraints, districts had to be purposively rather than randomly selected. The main aim of the selection process was to choose a group of districts containing hospitals which would reflect the range of types of district hospital in Malawi in terms of size, range of services offered, staffing, age of buildings and geographical location.

### Estimation of total district costs

Due to the nature of the accounting system, total district costs had to be put together from several sources.

Expenditure controlled at district level. With the exception of salary costs, the great bulk of recurrent expenditure of districts could be identified with individual districts. A particular problem arose in the calculation of drug and medical supplies costs, since annual expenditure is not necessarily a good reflection of the value of drugs used (due to changes in stock levels and donated items). In order to overcome this problem and to estimate the cost of drugs by hospital departments, the information required on drug quantities was obtained from sampling the duplicate books used by hospital wards and departments to order drugs (usually daily) from the pharmacy, and from health centre monthly requisition forms. Central Medical Stores prices were applied to drug quantities used to obtain total cost. This was then converted to a cost per day, and multiplied up to give an annual cost. Donated drugs were therefore in effect

costed at Medical Stores prices for equivalent drugs. Vaccine costs were estimated on the basis of quantities used and price CIF Malawi and added in.

The 1987 quantity of X-ray film used by film size was noted from departmental records and its cost allocated to the wards and OPD on the basis of an analysis of the origin of patients X-rayed and film size used (origin and film size is routinely noted in the X-ray department ledger).

Salary costs. Salaries are paid centrally and it was possible only to calculate actual district salary costs for two broad staff groupings; senior staff and junior staff. Since the cost apportionment process required more detailed data, salary costs were estimated based on staff numbers by type and grade and average salaries (mid-point of the salary scale). Total actual costs were used to cross-check this estimation procedure. 10% was added to the annual salary cost of pensionable staff to allow for employment benefits.

An important category of employment benefit in Malawi is subsidised housing. The cost of housing was treated as a capital cost (see below) rather than a staff-related cost, but the significance of this employment benefit is discussed later in terms of the additional salary it represents.

Other recurrent costs. Specialists from the two central hospitals made (fairly) regular visits to district hospitals. These visits were ignored, on the grounds that they were fairly similar for most hospitals, it was difficult to get an accurate

estimate of length of stay and amount of work done, and the sums involved would have been fairly minor. A few expenditure items, notably most postal charges, are paid centrally and not charged to districts. It was not possible to investigate these in this analysis and they are likely to be an insignificant proportion of total district expenditure.

**Capital costs.** Capital costs comprise hospital buildings and equipment, rural facilities and equipment (rural hospitals, health centres, dispensaries, maternities), staff housing, vehicles and motor bikes. They were in general based on the 1987/8 estimated cost of a standard unit (hospital, house, vehicle, etc.), unadjusted for location, since time constraints prevented the detailed site-specific measurement and costing necessary to relate replacement cost closely to existing facilities. Costs were annuitized assuming a length of life of 30 years for buildings, 10 years for equipment, 3 years for linen and bedding, 10 years for ambulances, 6 years for a car and 4 years for a motor bike. A real rate of interest of 3% was used in calculating annual costs, to allow for the opportunity cost of capital purchases.

#### Apportionment of district costs

It was decided that the ultimate purpose of the analysis was to allocate all costs to departments providing direct patient care, namely the wards, outpatient department (OPD), maternal and child health department (MCH) and rural facilities.

Diagnostic and support departments such as theatre, X-ray and laboratory were viewed as providing services to these direct

patient care departments. The methodology adopted here, therefore, is slightly different from the standard hospital costing methods used in the US <sup>(2)</sup> where the prime aim is to allocate costs out to "revenue-producing" departments and no clear distinction is made between the direct patient care departments and the diagnostic and support departments.

The MoH accounting system does not distinguish between hospital and out of hospital expenditure. An estimation procedure therefore had to be used not only to apportion costs between hospital departments but also between the hospital and rural facilities. The apportionment procedure occurred in three stages. In the first, expenditure by line item was grouped into a smaller number of categories. In the second, costs were allocated to cost centres. In the third, the costs of cost centres were 'stepped-down' to departments providing direct patient care.

Cost centres are listed in Table 1 and the criteria used for the allocation of costs to cost centres are shown in Table 2. Most are self-explanatory, with the exception of staff costs. The majority of staff could be directly allocated to cost centres on the basis of their duties or a rota. The remaining staff were either interviewed and asked how they spent their time, or that information was estimated by the District Health Officer or Matron. A step-down procedure was used to distribute costs to direct service departments. The order is important since costs are stepped down from a particular cost centre to following cost centres and not to cost centres that precede it. A more elaborate apportionment procedure was not, however, considered



worthwhile since the costs to be apportioned resulted from an estimation procedure and were thus approximate. The criteria by which costs were distributed to direct service departments are shown in Table 3.

#### Main methodological problems

At this point it is useful to point out the main problems encountered so that the results can be viewed in the light of these problems.

**Staff costs.** The use of average salaries to calculate total salary and wage costs may introduce inaccuracies. This was checked by comparing the total salary and wage bill according to this analysis (excluding the pension contribution) with total actual expenditure. In general, actual and estimated expenditure were extremely close. Subjective estimates had to be relied on to allocate the time of staff who had duties in more than one cost centre. This was, however, a relatively small proportion of total staff.

**Vehicle running costs.** Time permitted the analysis of logbooks for only one sample month, and logbooks for all vehicles in use in 1987/8 could not always be located. The majority of logbooks, however, were analysed.

**Drugs.** Again, time constraints meant that the time period used to analyse drug supplies was very short. It did seem, however, that wards ordered what they needed on a day-to-day basis and did not keep large stocks. The period studied should therefore be reasonably representative, at least of that time of year.

Further investigation would be required of the extent to which the time of year was representative of the whole year. Similar comments apply to OPD and health centre orders.

**Capital.** Capital costs are likely to be very approximate. The hospital building cost was a Ministry of Works estimate, presumably reasonably accurate and reflecting local conditions. The equipment cost, however, derived from an EEC tender and the equipment specification seems to be to European standards. It is therefore not necessarily a good reflection of the value of most of the equipment currently in district hospitals and historical records of its value were not readily available. Because of these problems, most results are presented for recurrent costs only.

**Activity statistics.** The cost analysis relies on activity statistics both in the apportionment procedures and in the production of the final unit costs. Unfortunately few hospitals paid much attention to inpatient statistics which were frequently incomplete. The information available, other sources of data (e.g. ward admission books and daily inpatient census records) and advice of district staff were used to estimate missing data, or to compile alternative statistics. On balance, it seems likely that statistics on admissions are more accurate than statistics on inpatient days. Outpatient statistics, when available, recorded only new outpatients not total visits. Where possible, estimates of total visits were also obtained.

## **THE DISTRICT HEALTH SYSTEM**

Health care in the districts is the responsibility of the District Health Officer (DHO), who is responsible to a Regional Health Officer. Responsibility for the day-to-day running of the hospital is usually delegated to a Chief or Senior Clinical Officer and to the Sister-in-Charge and Hospital Secretary. The District Health Inspector is responsible for preventive activities and reports both to the DHO and Regional Health Inspector.

A number of staff based at the district hospital have district-wide responsibilities, most notably the DHO, district health inspector, TB assistant, leprosy assistant, MCH co-ordinators (male and female) and ophthalmic assistant.

Ministry of Health services in all districts are complemented by mission facilities ranging from general hospitals similar to the Ministry's own district hospitals to simple dispensaries. Many district councils provide maternity units and occasionally dispensaries. The quality of the services provided by these other agencies varies considerably. The extent of co-ordination and joint working also varies, and is probably greatest in the field of MCH care.

MOH services are to all extent and purpose provided free.

## RESULTS

### Distribution of total costs by input category

Table 4 shows the distribution of recurrent and total district costs by broad input category. There are two striking features in this table. The first is the low proportion of recurrent costs absorbed by salaries and wages (27% to 39%). The second is the high proportion (46% to 57%) absorbed by the annual value of capital, of which buildings and equipment are the most significant and transport very small. As a proportion of total recurrent costs, drugs and medical stores take up between 24% and 37%, and vehicle-associated costs between 11% and 18%. Food, the only other significant item of recurrent expenditure, takes up 3% to 7%.

### Distribution of costs by cost centre

When costs are distributed by cost centre, the pharmacy is the most costly department absorbing 25% to 38% of total recurrent costs. Administration absorbs 5% to 9%, maintenance under 4% and in four districts under 2%, and the kitchen 5% to 9%. The medical support departments apart from pharmacy - laboratory, X-ray and theatre - have low direct costs.

### Distribution of recurrent costs by direct service departments and unit recurrent costs

Table 5 shows total recurrent costs distributed to direct service departments (wards, OPD, MCH, environmental health, and health centres and PHC), and Tables 6 to 9 unit recurrent costs per bed, per inpatient, per inpatient day, per new outpatient and per

outpatient. Deficiencies in hospital statistics mean that it is not possible to calculate all these unit costs for all districts.

The distribution of recurrent costs in Table 5 gives an accurate picture of the resources absorbed by rural services as opposed to the hospital, namely 27% to 39%. While the hospital absorbs 61% to 73% of district recurrent costs, part of this is spent on primary health care services for the hospital's local population. The secondary care services of the hospital absorb 40% to 58% of district recurrent costs.

The relative importance of the different wards varies considerably between the hospitals. In Salima and Kasungu maternity has the largest share, in Chiradzulu and Rumphi the children's ward, and in Mulanje and Nkhata Bay the male ward. However, none of these differences is very large, except the occasional one which reflects major differences in bed numbers between the wards (for instance, the small maternity in Mulanje).

The unit recurrent costs show considerable variation between the hospitals. The most expensive hospital is consistently Mulanje, and the cheapest, Rumphi. In terms of cost per bed, Mulanje is 75% more expensive than Rumphi, in terms of cost per inpatient, 83% more expensive, and in terms of cost per inpatient day, 238% more expensive.

These differences should, however, be interpreted with great caution since they are highly sensitive to the accuracy of the activity statistics used. Mulanje reports a bed occupancy rate of 76%,

which is implausibly low. The range of unit recurrent costs is probably better represented by excluding Mulanje, in which case cost per inpatient varies between K45.42 (Rumphi) and K64.88 (Salima), and cost per inpatient day between K3.52 (Rumphi) and K9.64 (Nkhata Bay).

The average hospital-wide unit cost disguises considerable differences between the various wards. In terms of cost per inpatient (Table 7), after the TB ward which is costly because of the length of stay, the male ward is on the whole the most expensive, and the children's and maternity wards the cheapest. In terms of cost per inpatient day (Table 8), the male and female wards tend to be cheaper than the children's and maternity wards. The cost of the TB ward is to some extent distorted by whether refinah (a very expensive drug) was supplied in the period analysed. Excluding the TB ward, maternity is the most expensive ward in terms of cost per inpatient day in 5 of the 6 hospitals.

Outpatient statistics are incomplete so comparisons are difficult. An additional problem is that while the cost per hospital outpatient reflects the cost of the outpatient department alone, the cost per health centre and rural hospital outpatient includes the cost of other activities (maternity for many health centres, general inpatient activities for rural hospitals) which could not be separated out in the time available for this study.

The cost per new hospital outpatient (Table 9) varies between K0.91 (Chiradzulu and Kasungu) and K2.48 (Mulanje), with the other hospitals in the range K1.14 to K1.53. Again, Mulanje

is probably overestimated, in this instance because of possible overestimation of outpatient drugs. On the whole, those hospitals that provide relatively cheap inpatient care also provide relatively cheap outpatient care, though Rumphi's extremely low inpatient unit costs are not replicated in the OPD.

Allowing for the distortion in the cost per health centre and rural hospital outpatient, it seems likely that health centres and rural hospitals provide outpatient care at a slightly lower cost than the hospital.

It should be possible to estimate the unit costs of the various cost centres, particularly the laboratory and theatre. Neither of these, however, kept sufficiently good records to quantify their activities and weight them for their intensity of resource use. The cost of the kitchen can be divided by the number of inpatient days to produce a unit cost (see Table 10). This shows considerable variation in both the unit cost of the kitchen and of its food component between hospitals. This variation is primarily due firstly to differences in expenditure on food relative to the numbers of inpatient days, some hospitals such as Rumphi and Salima being relatively economical, and secondly to the cost of water and heating.

The addition of annualized capital costs to recurrent costs has only a small effect on the ranking of hospitals in terms of unit costs. This is to be expected since capital costs are based on a common replacement cost for a standard hospital and adjusted only for the relative size in terms of beds of each hospital.

### Unit costs

The difference in the unit costs of outpatients and inpatients demonstrates the scope for increasing efficiency by replacing inpatient care by outpatient care if the characteristics of patients permit this. The ratios between the recurrent cost per new outpatient, per inpatient day and per inpatient are as follows:

Chiradzulu	1	:	6	:	55
Kasungu	1	:	10	:	52
Mulanje	1	:	5	:	34
Nkhata Bay	1	:	8	:	45
Rumphi	1	:	3	:	40
Salima	1	:	5	:	42

⋮



## DISCUSSION

### Mix of inputs

The low proportion of costs taken up by manpower requires some discussion. The main employment-related benefit not included here is subsidised housing. Staff entitled to housing (which is most staff) pay 10% of their salary in rent or a maximum of K60 a month. In the main cities, a market rent for the house occupied by an officer paying K60 a month would be considerably more than this - for example, K500-600 in Lilongwe. Subsidised housing, therefore, is one part of the explanation for the low proportion of costs taken up by manpower. Another contributory factor is rates of pay that are below their true market level. For certain professional categories, especially pharmacists and pharmacy and laboratory assistants, private sector pay rates are higher than government rates, contributing to difficulties in retaining these staff in the public sector. It is difficult to assess the extent to which medical and nursing salaries are below private sector rates given the small size and particular characteristics of the private sector. In international terms, public sector salaries are certainly very low and since prices paid for other important health service inputs (especially drugs and vehicle-related costs) will be close to international levels, the salary and wage share of total expenditure is lower than in countries with a different price structure of inputs and does not reflect its purchasing power in terms of manpower services.

However, the low salary and wage share is also a reflection of the staff mix. Medical officers constitute only 3-6% of staff costs overall in the six districts. The technical and technical assistant grades constitute between 25% and 33%, and nurses between 21% and 37%. There is thus a heavy reliance on technical, auxiliary and nursing staff. Clinical officers run the hospital under the overall supervision of the DHO and do much of the ward and OPD supervision and surgery. Enrolled nurses provide the bulk of the nursing on the wards, and medical assistants the bulk of the care in the OPD. Other types of technical assistant run the pharmacy, X-ray, ophthalmology, dental and MCH departments, and the leprosy and TB programmes.

In contrast to many African countries, staff were provided with the resources with which to work. For example, there was little evidence that inputs of pharmaceuticals were overall in short supply. Shortages of particular types of drug did occur, but resulted more from ordering and supply problems than budget constraints. If anything, some pharmacies were over-supplied with some drugs and supplies as a result of not relating orders to consumption patterns or poor stock-keeping. Transport services, similarly, did not appear to be constrained by lack of money for fuel: the availability of vehicles in operating order was the main constraint.

The annual value of capital takes up an extremely high proportion of total costs. It is likely that capital (especially imported building supplies and equipment) is expensive relative to recurrent inputs, not least because salaries and wages are low.

However, further investigation is required to determine whether capital costs have been overestimated here.

The relationship between capital and all recurrent costs can be expressed by means of the recurrent cost coefficient.<sup>(3)</sup>

This is not straightforward to calculate, however, since there is scope for argument over what recurrent costs should be included, given the hospital's district role. Should the recurrent costs be purely those of activities which take place on the hospital site, or should they include the costs of servicing the district (supervision, drug supply, etc.)?

Two recurrent cost coefficients were calculated and can be regarded as minimum and maximum estimates. The first includes the recurrent costs of all hospital departments providing services within the hospital. The second includes the recurrent costs of all hospital-based cost centres (i.e. excluding only the direct running costs of health centres, rural hospitals and PHC). The capital cost in both cases is that of hospital building and equipment, excluding staff housing. The means of the two estimates for the six districts were 0.11 and 0.14. These ratios suggest that the recurrent cost coefficient of Malawian district hospitals is low by international standards, reflecting the cheapness of many recurrent inputs, especially staff, relative to capital inputs, especially equipment.

#### Unit costs

Unit costs are an important guide to efficiency but need to be interpreted cautiously. Their major shortcoming is that the available indicators of output, such as bed-days, ignore any

quality differences that may exist between hospitals, Often, however, unit cost differences between hospitals are so great that quality is unlikely to account for all the variation. Moreover, the interpretation of certain unit costs, for example, the cost of food per inpatient day, is less affected by quality considerations.

The variation found in unit recurrent costs between the six hospitals clearly requires explanation. The first consideration is whether like is being compared with like. Chiradzulu, for example, is a small hospital, without a doctor or X-ray, transferring many cases to Blantyre. Not surprisingly, it has low unit costs. Rumphi, however, acting as the referral hospital for the Northern Region and staffed by two doctors, has unit costs almost as low. Differences in the type of hospital do not therefore inevitably lead to differences in unit costs.

Because a significant proportion of hospital costs are fixed, the intensity with which resources are used is likely to influence strongly unit costs. The first step in elucidating the unit costs is therefore to look at bed occupancy rates and lengths of stay. These are shown in Table 11. The two hospitals with the highest bed occupancy rate, Chiradzulu and Rumphi, have the lowest unit costs. Salima is operating at around 100% and Nkhata Bay and Mulanje are lower (though there are discrepancies in the statistics). Nkhata Bay has the lowest overall length of stay after Kasungu, explaining its better ranking on the cost per inpatient than the cost per inpatient day indicator.

Lengths of stay vary considerably, being lowest overall in Kasungu and Nkhata Bay, and far highest in Rumphi. Some reassurance that this statistic is of approximately the correct

order of magnitude is given

/ by the fact that hospitals rank consistently as long or short stay whatever ward is taken. In general, though, children and maternity patients have shorter lengths of stay than patients in the male and female wards. The variation in lengths of stay between hospitals suggests scope for reducing length of stay, notably in Rumphi but also in Salima, Mulanje and Chiradzulu.

By international standards, however, these lengths of stay are already relatively low. It is very unlikely that case-mix differences would explain all the variation in length of stay, especially between Kasungu, Mulanje and Salima, though Rumphi does have a regional role.

Bed occupancy rates and lengths of stay therefore explain some of the unit cost variation between hospitals, notably the low cost per inpatient day in Rumphi, but not all of it. For example, Nkhata Bay and Mulanje have very similar bed occupancy rates and fairly similar lengths of stay, but Mulanje is over 50% more expensive than Nkhata Bay in terms of cost per inpatient and 20% more expensive per inpatient day. There is clearly a difference in the efficiency with which hospitals use resources that is independent of occupancy rates or length of stay. In order to explore this further, it is important to distinguish those costs which can be locally controlled and those over which the hospital has no control. For example, the source of heat for kitchen and laundry (mains electricity or wood) and the technical efficiency of the equipment strongly influence cost and cannot be changed locally. However, other costs are more susceptible to local control. Of these, those which varied most were food and drugs. For example, the detailed analysis of drugs' supplies to OPD and wards showed considerable variations in practice between hospitals, which seem unlikely to be related simply to the characteristics of patients. The cost of drugs per new outpatient varied between K0.55 and K1.84. In one hospital,

supplies of tablets and injections were strictly controlled but large quantities of bandages were regularly supplied. Some hospitals used large quantities of intravenous fluids and others less. Antibiotic usage also varied enormously, and whether tablets or injections were given.

Some of the variation between hospitals in the kitchen unit cost might be explained by regional price differences though these seem unlikely to explain it all. The number of inpatient days may well be inaccurate, but it seems unlikely that faulty statistics can explain the very large variation. Chiradzulu and Nkhata Bay, in particular, appear to have reasonably reliable inpatient statistics, but Nkhata Bay's kitchen unit cost is two and a half times that of Chiradzulu (and the unit cost of the food alone almost that).

#### District-wide distribution of resources

To a considerable extent, the distribution of resources district-wide is determined by the physical infrastructure of rural facilities. This helps to explain, for example, why health centres and PHC absorbed 27% of district recurrent costs in Chiradzulu (which has few rural units that it controls) and 39% in Mulanje (which has many rural units).

Considerable resources are, however, based at the hospital which are expected to serve the district as a whole. This is true, for example, of the MCH staff, the TB, leprosy and ophthalmic assistants, the DHO and possibly other senior staff, and transport services. The extent to which staff could perform district-wide functions was crucially dependent on the availability of transport,

though on the whole, transport seemed less of a major constraint for the outreach activities of MCH staff, which were numerous.

Two indicators of the effort put into district-wide activities are the share of DHO time spent on district supervision and the share of vehicle mileage devoted to health centre and PHC activities. The amount of time the DHO said he devoted to district supervision varied between 9% and 25%. Most DHOs spent one day a week. It therefore seems that, despite the district-wide responsibilities of the DHO, he found it difficult to avoid spending the great majority of his time based in the hospital. About 30-40% of his total time was spent on district administration, and the remainder on hospital clinical duties (including teaching). Virtually no other senior staff were involved in district supervision: only one sister-in-charge said she did some supervision of maternity units.

The vehicle logbook analysis indicated that only around 20% of vehicle mileage was used for PHC, with the great majority of mileage devoted to inpatients, i.e. transporting patients to and from hospital, or returning dead bodies to their homes. The requirement to have vehicles available for patient transport was clearly a major factor in the lack of transport for other activities, notably PHC.

## CONCLUSIONS

The cost analysis enabled conclusions to be drawn under three headings: the efficiency of hospital operations, scope for re-distribution of resources district-wide, and the costing methodology and scope for more routine cost analysis.

### Efficiency of hospital operations

**Factor mix:** Areas were identified where improvements in efficiency might be feasible. For example, there was scope for economizing on drugs through better purchasing, stock control, distribution and prescribing. Scope for economy also appeared to exist in some hospitals in food purchasing and vehicle running costs. Conversely, sums spent on maintenance appeared to be inadequate to maintain buildings.

Although capital costs seem high relative to recurrent costs, there was little evidence that buildings were unduly lavish. Standards had certainly risen in recent years, new hospitals being notably more spacious in all departments than old ones. This has meant a greater ability to organise patient movement and care efficiently, and more generous space for outpatient and MCH services and administration in particular.

Although vehicle running costs were a major contributor to recurrent costs, annuitized vehicle capital costs were relatively insignificant. There would seem to be scope for exploring the possibilities of expanding the vehicle fleet with more economical vehicles.



**Improvements in hospital organization.** Many of the problems apparent in the hospitals derived from organizational weaknesses. Those areas most in need of organizational improvements were the pharmacy, supplies and transport. In particular, since the pharmacy was the greatest single manager of resources in the whole district, there would seem to be a strong case for strengthening staffing and management.

**Changes in utilization levels and length of stay.** The hospitals studied were certainly not under-utilized: indeed, crowding was a serious problem. On the basis of comparisons between hospitals, there seemed to be scope for some reductions in lengths of stay. In contrast, the OPD was generally felt to be over-used for minor ailments. In highly populated districts, such as Kasungu and Mulanje, the OPD was felt to be a drain on hospital resources, especially staff time. One possible partial solution would be nominal fees, to discourage those with minor complaints.

**Alternative technologies.** Are there other approaches to patient care that might improve the efficiency of hospital operations? DHOs felt the scope for shifting some hospital activities to health centres was limited, though rural hospitals offered more potential. Further investigation would be required to assess whether rural hospitals are likely to provide more economical care for certain types of patient.

Given the insignificant cost of diagnostic services relative to total hospital costs, it is worth investigating whether improved laboratory services would permit better standards of

care and faster discharge. At present most district hospitals are limited to a very basic range of haematology, biochemistry and parasitology tests, other tests being referred to Blantyre or Lilongwe (50-60 a week in the case of Salima).

Further investigation is required also of health centre costs, since they offer an alternative source of care for both out-patients and maternity patients. Maternity care in some hospitals is one of the more expensive types of inpatient care, and takes up 10-15% of hospital recurrent costs. A comparison would be particularly interesting of the cost and workload of hospital maternity care and urban maternity unit care, where this exists.

#### Re-distribution of district resources

In recent years there has been a notable growth in the numbers of staff based at the district hospital who have district-wide responsibilities. Transport is vital to the efficient use of their time. In the absence of adequate transport, they are presumably underemployed unless, as is likely to be the case with MCH services, there are sufficient hospital-based activities to occupy them.

The transport problem is not merely one of absolute shortage but also of priorities: district outreach activities are in effect given lower priority for transport than inpatients or administrative activities. They are probably more easily postponed. A similar problem is evident with regard to the DHO's time: hospital concerns tend to drive out primary health care concerns despite DHOs seeing the stimulation of PHC as one of their main functions.

There is no easy solution to changing priorities. Earmarking vehicles for particular activities has been tried and may help, though such vehicles seemed to be frequently off the road.

### Costing methodology

This analysis has shown that detailed costing of hospital operations is feasible in a country such as Malawi, despite the inclusion of rural facility and hospital expenditure in a single district budget and the poor availability of information on district salaries and wages. Indeed, the greatest problem lies not in the accounts but in obtaining accurate activity statistics. The analysis has also shown that such costing can lead to useful conclusions on district resource allocation patterns and hospital efficiency.

This type of analysis cannot be done in Malawi on a routine basis given the current accounting system, but marginal changes could facilitate the more regular production of unit costs which would be of use in planning and management. For example, minor changes could be introduced in routine information systems which would permit health centre and hospital costs to be separated.

Analysing intra-hospital costs would remain a problem. A possible solution is not to attempt to produce departmental unit costs, other than the broad categories of inpatients and outpatients. The analysis here suggests that overall unit costs per outpatient, inpatient and per inpatient day give a reasonable indication of the relative costliness of different hospitals, and thus could be used to monitor hospital efficiency, supplemented by such easily calculated unit costs as cost of food per inpatient day.

This would simplify the drug analysis, and make it feasible to use pharmacy tally cards to note the issue of supplies for inpatient and outpatient use.

Finally, in any discussion of further hospital cost analysis, consideration should be given to the virtues of a prospective rather than retrospective analysis. This has proved feasible in Malawi in the past (Ministry of Health, Malawi, unpublished report, 1975), and enables temporary changes to be made in information systems to permit the desired analyses. It also helps to ensure that existing information systems are well kept, which is particularly vital in the case of hospital and health centre activity statistics. As the analysis here has shown, inaccuracies in activity statistics make assessments of hospital efficiency extremely difficult, and such statistics are unlikely to be well kept unless it is known they will be used.

The case study also provides conclusions of relevance to other countries. It was found to be extremely useful to look in detail at the allocation of resources within hospitals, especially of staff time and drugs. The inpatient/outpatient allocation of resources is particularly important to investigate, rather than simply apportioning costs on some assumption of the ratio of cost per outpatient to cost per inpatient day, as is often done. It is also important to look at the hospital's role in the district health system, and the extent to which its resources and skills serve the district as a whole.

Other countries contemplating similar studies may find it useful to know that the data collection phase took 17 working days for one expatriate and one local economist, the drug analysis 7 days of a computer operator, and the data analysis and report writing approximately 20 working days for the expatriate economist.

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**Table 1. Cost centres**

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Administration of district  
Maintenance of buildings and grounds for district  
Transport  
Domestic  
Laundry  
Kitchen  
Pharmacy  
Laboratory  
X ray  
Theatre  
Male ward  
Female ward  
Paediatric ward  
TB ward  
Hospital outpatients department  
Hospital maternal and child health department  
Environmental health department at hospital  
Rural hospitals  
Health centres and primary health care

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**Table 2: Criteria for allocation of costs to cost centres.**

<b>Cost Item</b>	<b>Allocation Criteria</b>
<b>Recurrent Costs</b>	
Domestic supplies	to domestic cost centre
Food	to kitchen cost centre
Vehicle-associated recurrent costs	to transport cost centre
Heating, lighting	in proportion to likely energy use of cost centres
Hospitality	to administration cost centre
Staff associated costs	in proportion to salary costs by cost centre
Maintenance, buildings	to maintenance cost centre
Maintenance, office equipment	to administration cost centre
Maintenance, plant	location of plant
Postage, printing	to administration cost centre
Public Transport (i.e. travel warrants for patients)	to wards in proportion to inpatients
Medical supplies	to pharmacy
Subsistence, transport claims	10% to administration, 90% to health centres and PHC
Telephone, telex	to administration cost centre
Water, sanitation	in proportion to likely use by cost centres
Bicycle maintenance	to health centres and PHC
Uniforms (staff and patients)	80% to wards in proportion to inpatients, 2% to OPD, 0.5% to MCH, 10% to health centres
Salaries and wages	according to distribution of staff time by cost centre
<b>Capital costs</b>	
Buildings	to hospital, in proportion to floor space by cost centre; to health centres, etc. directly
Equipment	hospital equipment list broken down by cost centre; health centre equipment estimated
Staff houses	for hospital houses, in proportion to salary costs
Vehicles	to transport
Motorbikes	to transport



**Table 3: Criteria for distribution of cost of cost centres to direct service departments**

Cost centre	Distribution criteria
Administration	Direct costs of cost centres
Maintenance	30% to health centres; 70% to hospital distributed on the basis of floor area.
Transport	Shared between administration, wards and health centres and PHC on the basis of an analysis of logbooks: the administration share was allocated in proportion to the direct costs of cost centres following the transport cost centre; the ward share to wards in proportion to inpatients.
Domestic	Floor area of hospital after health centre supplies had been subtracted.
Laundry	Inpatient days by ward.
Kitchen	Inpatient days by ward.
Pharmacy	Estimation of actual use of drugs and medical supplies
Laboratory	Estimated allocation of time between inpatients and outpatients, and to wards in proportion to inpatients.
X-Ray	Actual use of X-Ray department by OPD and wards.
Theatre	To maternity in relation to Caesarian sections as proportion of total major (weight = 1) and minor (weight = 0.5) operations; remainder in proportion to male and female surgical inpatients (if distinguished separately) or male and female inpatients.

Table 4. Distribution of costs by input category, 1987/8

Input category	Distribution of recurrent costs						Distribution of total costs					
	Chiredzulu	Kasungu	Mulanje	Nkhata Bay	Rumphi	Salima	Chiredzulu	Kasungu	Mulanje	Nkhata Bay	Rumphi	Salima
	£	£	£	£	£	£	£	£	£	£	£	£
Domestic supplies	1.67£	0.90£	1.43£	2.64£	1.23£	3.66£	0.88£	0.48£	0.77£	1.26£	0.54£	1.57£
Food	6.84£	5.78£	4.45£	7.35£	4.11£	3.11£	3.60£	3.04£	2.41£	3.51£	1.80£	1.33£
Vehicles	10.90£	15.27£	16.55£	14.83£	18.13£	13.94£	5.75£	8.04£	8.97£	7.09£	7.93£	5.96£
Heating, Lighting	1.03£	1.82£	1.57£	1.55£	0.78£	2.62£	0.54£	0.96£	0.85£	0.74£	0.34£	1.12£
Hospitality	0.00£	0.00£	0.03£	0.00£	0.03£	0.00£	0.00£	0.00£	0.01£	0.00£	0.01£	0.00£
Staff associated costs	0.89£	1.03£	0.77£	0.84£	1.20£	0.95£	0.47£	0.54£	0.42£	0.40£	0.53£	0.41£
Maintenance, buildings	2.75£	3.43£	0.99£	0.09£	0.95£	0.87£	1.45£	1.81£	0.54£	0.04£	0.42£	0.37£
Maintenance, plant	0.00£	0.19£	0.42£	0.00£	0.47£	0.13£	0.00£	0.10£	0.23£	0.00£	0.21£	0.05£
Maintenance, office equipment	0.00£	0.05£	0.05£	0.00£	0.00£	0.00£	0.00£	0.03£	0.82£	0.00£	0.00£	0.00£
Postage, printing etc	0.46£	0.78£	0.73£	1.85£	0.67£	1.29£	0.24£	0.41£	0.40£	0.89£	0.30£	0.55£
Public transport	2.01£	2.67£	1.56£	3.33£	2.52£	3.18£	1.06£	1.40£	0.84£	1.59£	1.11£	1.36£
Medical supplies	33.17£	28.28£	37.42£	24.99£	24.34£	26.71£	17.49£	14.88£	20.29£	11.95£	10.68£	11.43£
Subsistence, transport claims	0.72£	2.12£	1.58£	3.75£	1.79£	1.80£	0.38£	1.11£	0.86£	1.79£	0.79£	0.77£
Telephone, Telex	0.59£	4.75£	1.01£	0.24£	1.71£	3.19£	0.31£	2.50£	0.55£	0.12£	0.75£	1.36£
Water, Sanitation	1.70£	1.49£	1.87£	1.85£	2.05£	0.26£	0.89£	0.78£	1.01£	0.88£	0.90£	0.11£
Bicycles maintenance	0.00£	0.00£	0.00£	0.00£	0.00£	0.11£	0.00£	0.00£	0.00£	0.00£	0.00£	0.05£
Uniforms	3.23£	0.87£	2.30£	2.06£	0.97£	1.05£	1.70£	0.46£	1.24£	0.98£	0.43£	0.45£
Total non salary costs	65.95£	69.41£	72.72£	65.37£	60.96£	62.87£	34.78£	36.53£	39.42£	31.25£	26.74£	26.89£
Salaries and wages	34.05£	30.59£	27.28£	34.63£	39.04£	37.13£	17.96£	16.10£	14.79£	16.55£	17.12£	15.88£
Total recurrent costs	100.00£	100.00£	100.00£	100.00£	100.00£	100.00£	52.74£	52.63£	54.20£	47.80£	43.86£	42.78£
Buildings							23.48£	25.82£	26.03£	25.11£	30.26£	31.49£
Equipment							18.99£	17.22£	14.69£	19.80£	20.70£	19.04£
Staff houses							2.13£	2.70£	2.18£	2.90£	3.00£	3.77£
Vehicles							1.95£	1.19£	2.12£	3.63£	1.90£	2.59£
Motorbikes							0.71£	0.44£	0.78£	0.74£	0.28£	0.52£
Total capital costs							47.26£	47.37£	45.80£	52.20£	56.14£	57.22£
Total costs							100.00£	100.00£	100.00£	100.00£	100.00£	100.00£

Table 5. Distribution of recurrent costs by direct service department, 1987/8.

Hospital Departments	Chiredzulu %	Kasungu %	Mulanje %	Nkhata Bay (a) %	Ruaphi %	Salima %
Male ward	11.4	11.7	12.6	13.3	9.5	12.0
Female ward	9.4	11.7	8.1	9.3	10.7	11.9
Children's ward	13.8	7.7	9.7	11.0	12.7	13.1
Maternity	11.9	14.2	6.3	10.1	10.3	13.9
TB ward	11.5	2.4	3.6	5.2	1.4	4.5
Polio annex					3.9	
All wards	58.0	47.7	40.3	48.9	48.5	55.4
OPD	10.8	11.2	18.2	10.6	14.7	14.3
MCH/district hosp	2.3	2.8	1.7	1.8	2.4	2.0
Envir. hith/district hosp	1.5	1.3	1.0	2.1	2.0	0.9
Rural hospitals		5.1		12.2	16.2	
Health centres & PHC	27.4	31.9	38.8	24.4	16.2	27.4
All non-wards	42	52.3	59.7	51.1	51.5	44.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

(a) Urban health centre at Mzuzu is included under rural hospital category.

Table 6. Recurrent cost per bed by ward, 1987/8.

Hospital Departments	Chiradzulu (Kwacha)	Kasungu (Kwacha)	Mulanje (Kwacha)	Nkhata Bay (Kwacha)	Rumphi (Kwacha)	Salima (Kwacha)
Male ward	2,091	2,906	3,305	2,936	1,342	2,715
Female ward	2,036	2,900	3,051	2,053	1,515	2,690
Children's ward	5,962	3,986	3,533	5,557	3,309	2,976
Maternity	3,143	4,347	11,053	2,942	3,034	3,151
TB ward	2,104	1,007	1,351	1,433	1,634	1,082
Polio annex					2,053	
All wards	2,680	3,046	3,239	2,704	1,846	2,340

Table 7. Recurrent cost per inpatient by ward, 1987/8.

Hospital Departments	Chiradzulu (Kwacha)	Kasungu (a) (Kwacha)	Mulanje (Kwacha)	Nkhata Bay (Kwacha)	Rumphi (Kwacha)	Salima (Kwacha)
Male ward	54.41	72.85	100.16	78.35	53.55	70.13
Female ward	52.69	49.41	79.39	58.34	48.86	67.76
Children's ward	29.77	33.37	74.14	38.59	38.54	57.37
Maternity	44.90	38.56	63.04	43.97	59.33	56.86
TB ward	303.87	139.84	136.09	125.13	166.18	131.71
Polio annex					52.64	
All wards	50.26	47.10	83.06	55.18	45.42	64.88

(a) Based on official inpatient numbers, probably underestimated.

Table 8. Recurrent cost per inpatient day by ward, 1987/8.

Hospital Departments	Chiradzulu (Kwacha)	Kasungu(a) (Kwacha)	Kasungu(b) (Kwacha)	Mulanje (Kwacha)	Nkhata Bay (Kwacha)	Rumphi (Kwacha)	Salima (Kwacha)
Male ward	4.37	11.40	5.76	12.72	10.87	3.65	6.07
Female ward	4.14	8.05	4.12	13.22	8.90	3.56	7.99
Children's ward	5.65	8.16	8.4	11.12	8.98	3.87	8.53
Naternity	5.74	9.64	6.53	21.49	12.21	4.63	8.95
TB ward	8.94	5.81	2.46	5.44	6.91	6.65	4.39
Polio annex						2.92	
All wards	5.43	8.98	5.33	11.75	9.64	3.52	7.31

(a) Based on official inpatient numbers, probably underestimated.

(b) Based DHQ's estimate of inpatient days

Table 9. Cost per new outpatient, 1987/8. (a)

	Chiradzulu (Kwacha)	Kasungu (Kwacha)	Mulanje (Kwacha)	Nkhata Bay (Kwacha)	Rumphi (Kwacha)	Salima (Kwacha)
Hospital OPD	0.91	0.91	2.48	1.22	1.14	1.53
Rural hosp #1		1.10		0.92 (b)	0.90	
Rural hosp #2					1.40	
Rural hosp #3					1.15	
Health centres	0.76	1.88	N/A	1.43	1.13	1.17
All	0.79	1.42		1.14	1.13	1.27

(a) Estimated cost/outpatient visit was K0.64 (Kasungu OPD); K0.57 (Mulanje OPD).

(b) Urban health centre at Mzuzu is included under rural hospital category.

Table 10. Cost of provision of food

	Cost per inpatient day of the kitchen	Food as a % of cost
Chiradzulu	K0.80	80%
Kasungu	K1.48-0.88	73%
Mulanje	K1.95	66%
Nkhata Bay	K2.04	71%
Rumphi	K0.52	63%
Salima	K0.74	56%

Table 11. Bed occupancy rates and length of stay statistics, 1987/8.

Hospital		Male ward	Female ward	Children's ward	Maternity ward	TB ward	Polio annex	All wards
Chiradzulu	BOR (a)	131%	135%	289%	150%	64%		135%
	LOS (b)	12.4	12.7	5.3	7.8	34.0		9.3
Kasungu	BOR (c)	69.8%	98.7%	133.8%	100.0%	47.5%		88.0%
	BOR (d)	138.1%	192.9%	130.0%	182.4%	112.0%		156.4%
	LOS (c)	6.4	6.1	4.1	4.0	24.1		5.2
Mulanje	BOR	71.2%	63.2%	87.0%	140.9%	68.0%		75.5%
(e)	LOS	7.9	6.0	6.7	2.9	25.0		7.1
Nkhata Bay	BOR	74.0%	63.2%	169.6%	66.0%	58.5%		76.9%
(e)	LOS	7.2	6.6	4.3	3.6	18.1		5.7
Rumphi	BOR	100.6%	116.6%	234.1%	179.5%	67.4%	192.3%	143.6%
	LOS	14.7	13.7	10.0	12.8	25.0	18.0	12.9
Salima	BOR	122.6%	92.3%	95.6%	96.4%	91.4%		98.2%
	LOS	11.6	8.5	6.7	6.4	30.0		9.2

(a) BOR=bed occupancy rate

(b) LOS=length of stay

(c) Official statistics except maternity where 100% BOR and 4 day LOS is assumed.

(d) Calculated from daily head count records, thought by DHO to be more accurate though probably over-estimated

(e) Bed occupancy rates probably under-estimated.

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